Unemployment Benefits and Redistributive Taxes in the Presence of Labor Quality Externalities

Huizinga, H.P.

Publication date:
1996

UNEMPLOYMENT BENEFITS AND REDISTRIBUTIVE TAXATION IN THE PRESENCE OF LABOR QUALITY EXTERNALITIES

Harry Huizinga[1]

CentER and Department of Economics
Tilburg University

Revised January 1995

Abstract:

In this paper, a worker's productivity is assumed to depend on his own quality and on the average quality of other employed workers. In this setting, unemployment benefits that induce low quality workers to leave the labor force have important efficiency as well as equity implications. In addition to unemployment benefits, the authorities can use a proportional income tax and lump sum transfers. The desirability of tax and transfer policy is considered from the perspectives of a utilitarian social planner, and of an electorate consisting of employed and unemployed workers. Employed workers may be in favor of unemployment benefits, even though they do not benefit directly. If unemployment benefits are financed by lump sum taxes, then relatively high unemployment benefits may be favored by a coalition of the unemployed and of high quality employed workers.

[1] I thank Petra Geraats for useful comments on an earlier draft.

1. *Introduction*

Unemployment benefit schemes have been explained by Bailey (1978) and Fleming (1978) as insurance against the risk of job loss. Boadway and Oswald (1983) and Wright (1985) have considered the political economy aspects of such insurance. Zeckhauser (1971) and Cooter and Helpman (1974), among others, alternatively rationalize transfer payments to the non-working poor as acts of altruism. This paper offers a third rationale for unemployment benefits stemming from the fact that exits by relatively unproductive workers from the work force may in fact increase the productivity of remaining workers. This is the case if there are peer group effects in the work place in the sense that a worker's productivity depends on the quality of his co-workers as well as on this own quality. Henderson, Mieszkowski and Sauvageau (1978) and Arnott and Rowse (1987) argue that such peer groups are important in the class room setting, and they suggest that peer group effects may equally be important in the work place. Along similar lines, Sala-i-Martin (1992) introduces labor productivity externalities to explain mandatory retirement of older workers in a growth context.

Huizinga (1994) considers tax and transfer policy in a model of labor quality externalities for the case where the tax authorities have two fiscal instruments: (i) lump sum unemployment benefits, and (ii) proportional labor income taxes. This paper extends Huizinga (1994) by introducing a third fiscal instrument: a lump sum tax (or transfer) to all workers regardless of their employment status. With this wider instrument set, the tax authorities can influence workers' employment status as well as their individual labor effort when employed. The paper analyses and contrasts the three variants of the model where only two of the three policy instruments are available. The subcases where only two instruments exist are analysed for their own sake and to make the analysis comparable to earlier contributions on unemployment benefits and redistributive taxation. Finally, the case where all three policy instruments exist is also considered. Throughout, tax and transfer policy is examined from the perspective of a utilitarian social planner and of an electorate consisting of the universe of employed and unemployed workers.

If the policy set consists of universal lump sum transfers financed by proportional income taxation, then the model is very similar to Meltzer and Richards (1981). Lump sum transfers financed by labor income taxes will be favored by the median voter, if this voter has a lower than

average labor income. Secondly, we consider the case where the instrument set consists of lump sum transfers to the unemployed financed by universal lump sum taxes. In this scenario, unemployment compensation generally benefits unemployed workers, who are direct beneficiaries, and the most qualified employed workers, who stand to gain the most on account of the peer group effect. As a result, a coalition of the unemployed and the highly qualified employed may support higher unemployment benefits than those preferred by the median quality worker.

As a third case, the instrument set consists of unemployment benefits financed by proportional labor income taxes. In this instance, the benefits and costs of higher unemployment benefits to employed workers are both shown to be proportional to individual labor quality (and income). As a result, all employed workers have equal preferences over different combinations of unemployment compensation and labor income taxes. The unemployed, of course, are simply interested in obtaining the maximum net-of-tax unemployment benefits. The unemployed as a group thus also have identical preferences over feasible pairs of unemployment compensation and labor income taxation. The employed and the unempoyed thus will vote as separate blocs if tax and transfer policy is determined by elections. In this setting, equilibrium policy is determined by the median quality worker, after he has chosen whether he is better off as an employed worker or as an unemployed worker.

Finally, the policy set is assumed to consist of all three instruments: universal taxes or transfers, transfers to only the unemployed, and proportional income taxation. It is shown that there is a unique voting equilibrium, if the median quality worker can achieve highest utility as an unemployed individual. Unemployment benefits and labor income taxes are further demonstrated to be complementary in the sense that, starting from a political equilibrium where unemployment benefits exist, more people favor positive labor income taxation than in the absence of unemployment benefits.

The remainder of this paper is organized as follows. Section 2 outlines the basic model. Section 3 considers the three cases where the policy instrument set consists of two of the three instruments examined in the paper. Section 4 in contrast considers the case where all three instruments are at the authorities' disposal. Finally, section 5 concludes by drawing attention to the fact that the model is highly stylized. Several extensions are proposed that potentially affect the

model's basic implications.

2. *The model*

There is a fixed population of workers that are heterogeneous in their quality. Worker quality, denoted a, can be in part innate and in part the result of education.[1] The variable a is distributed on the interval $[\underline{a}, \bar{a}]$ with density function $f(a)$ and distribution function $F(a)$. The size of the population is unity so that $F(\bar{a}) = 1$. The population mean value of a is denoted $\bar{\mu}$. Workers can choose to be employed or to be unemployed. Let S be the share of the population that is employed, which implies that $1 - S$ is the unemployment rate. The mean quality of employed workers is denoted μ. All workers have 1 unit of time available. Individuals who are employed have to decide how much to work and how much leisure to consume. Let individual labor supply be denoted x so that leisure equals $1 - x$. On account of peer group effects, the productivity of any worker depends positively on the mean quality of all employed workers, μ. Peer group effects may exist because workers can learn from and copy relatively highly qualified workers, or they may be purely psychological. Individual output, denoted y, is related to individual worker quality, a, the mean worker quality, μ, as well as to individual labor supply, x. Formally, individual output, y, is given as follows,

$$y = x\, a\, \mu^{\alpha} \qquad \alpha > 0 \tag{1}$$

Aggregate output, Y, is the sum of the output of all workers as follows,

$$Y = \int_{\hat{a}}^{\bar{a}} x\, a\, \mu^{\alpha}\, f(a)\, da$$

$$= x\, \mu^{1+\alpha}\, S \tag{2}$$

where $\hat{a}$ is the borderline quality of a worker, if any, who is indifferent between working and not working.

Equation (2) displays what can be called increasing returns to average quality, as national output, Y, increases more than linearly with mean worker quality, μ, while there are only constant returns to scale, S.[2]

Individuals derive utility from consumption and from leisure. Let C be the level of consumption, and let $aV(1 - x)$ be the subutility derived from leisure, with $V' > 0$, $V'' < 0$. This specification reflects the assumption that a worker's enjoyment of leisure increases with his quality, a. The overall utility measure, denoted U, is assumed to be separable in consumption and leisure as follows,

$$U = C + aV(1 - x) \tag{3}$$

Let us now consider the policy instruments at the disposal of the fiscal authorities. As is usual, the government cannot observe or tax worker quality directly. A worker's employment status, however, is observable, and thus the goverment can implement a lump sum transfer, b, to only unemployed workers. Also, the government can tax labor income at a flat rate τ. For purposes of taxation, unemployment benefits are considered labor income. To balance the budget, the government finally provides a lump sum transfer, t, to all citizens regardless of their employment status. If negative, t represents a lump sum tax.

Employed workers have to decide how much they will work. The optimality condition regarding individual labor supply, x, if positive is as follows,

$$V'(1 - x) = (1 - \tau)\mu^{\alpha} \tag{4}$$

Equation (4) reflects that individual labor supply, x, is independent of worker quality, a. A worker obtains utilities, U_e and U_u, if employed and unemployed, respectively. These two utility levels are given as follows,

$$U_e = (1 - \tau)y + a\,V(1 - x) + t \tag{5}$$

$$U_u = (1 - \tau)b + a\,V(1) + t \tag{6}$$

where in (5) individual labor supply x is chosen optimally.

Equations (5) and (6) reflect that employed and unemployed workers receive net labor incomes equal to $(1 - \tau)y$ and $(1 - \tau)b$, respectively.

An individual worker of quality a chooses to work if U_e in (5) exceeds U_u in (6), and vice versa. Setting $U_e = U_u$ from (5) and (6) implies that this borderline quality level, $\hat{a}$, is given implicitly as follows,

$$(1 - \tau)b + \hat{a}\,V(1) = (1 - \tau)\,x\,\hat{a}\,\mu^{\alpha} + \hat{a}\,V(1 - x) \tag{7}$$

All workers of quality higher (lower) than $\hat{a}$ clearly choose (not) to work. The labor participation rate, S, is now given by $1 - F(\hat{a})$, while the unemployment rate equals $F(\hat{a})$.

From equations (6) and (7), we can derive how the unemployment benefit level, b, and the income tax rate, τ, affect individual labor supply, x, and the threshold worker quality level, $\hat{a}$, given that some workers are unemployed. Qualitatively, the relationships between the fiscal variables, b and τ, and the labor market variables, $\hat{a}$ and x, are as follows,

$$\frac{d\hat{a}}{db} > 0, \quad \frac{dx}{db} > 0, \quad \frac{d\hat{a}}{d\tau} > 0\ , \quad \frac{dx}{d\tau} < 0 \tag{8}$$

Exact expressions for the derivatives in (8) are provided in the Appendix. Equation (8) first indicates that a higher benefit, b, increases the threshold quality level, $\hat{a}$, as a higher value of b induces the lowest qualified employed workers to exit from the work force. The resulting increase in the mean quality of remaining workers, μ, increases the productivity of remaining workers and, as seen in (8), their labor supply, x. Turning to the income tax rate, we see in (8) that a higher tax rate, τ, also increases the threshold quality level, $\hat{a}$. To understand this, note that employed workers receive relatively much labor income, and enjoy relatively little leisure. The labor income tax, τ, thus is borne relatively heavily by employed workers, and as a result it discourages the labor participation of marginal workers. Finally, we see in (8) that a higher labor income tax rate, τ,

reduces individual labor supply, x.

It is interesting to consider how the unemployment benefit, b, and the tax rate, τ, affect aggregate output, Y. From (2), we can find that,

$$\frac{dY}{db} = \mu^{1-\alpha} S \frac{dx}{db} + x \mu^{\alpha} [\alpha\mu - (1 + \alpha)\hat{a}] f(\hat{a}) \frac{d\hat{a}}{db} \tag{9}$$

$$\frac{dY}{d\tau} = \mu^{1-\alpha} S \frac{dx}{d\tau} + x \mu^{\alpha} [\alpha\mu - (1 + \alpha)\hat{a}] f(\hat{a}) \frac{d\hat{a}}{d\tau} \tag{10}$$

Using the qualitative expressions in (8), we see that higher unemployment benefits, b, lead to higher aggregate output, Y, if $\hat{a} < \alpha\mu/(1 + \alpha)$. This condition is more easily satisfied, the larger is the parameter α that reflects the strength of the relationship between individual output, y, and mean worker quality, μ, in (1). Equation (10) indicates that a higher labor income tax rate, τ, can lead to a higher aggregate output, Y. In the limiting case where labor supply, x, is completely inelastic, for instance, we see that $\hat{a} < \alpha\mu/(1 + \alpha)$ is a necessary and a sufficient condition for a higher income tax, τ, to lead to higher aggregate output, Y. These results are summarized as follows,

Proposition 1: A sufficient condition for $dY/db > 0$ is $\hat{a} < \alpha\mu/(1 + \alpha)$. The latter condition is a necessary and sufficient condition for $dY/d\tau > 0$, if individual labor supply, x, is inelastic.

Next, let us consider the government budget. Let B be the government budget surplus. Formally, B is given as follows,

$$B = \tau Y - (1 - \tau)b(1 - S) - t \tag{11}$$

It is interesting to consider tax and redistributive policy, as determined by a social planner, as a benchmark. The social planner is assumed to have a utilitarian social welfare function, U_s, which is the sum of individual workers' utilities. Formally, social welfare, denoted U_s, is given as

follows,

$$U_s = \int_{\underline{a}}^{\hat{a}} U_u \, f(a) \, da + \int_{\hat{a}}^{\overline{a}} U_e \, f(a) \, da \tag{12}$$

Alternatively, we will assume that fiscal policy is determined by popular vote. In a voting equilibrium, policy reflects the preferences of a decisive voter who, as we will see, may not be the worker of median worker quality. In all cases, however, the decisive voter is either employed or unemployed. A decisive voter thus wishes to maximize either U_e in (5) or U_u in (6). Whatever policy instruments are availabe, any equilibrium policy is thus always set so as to maximize U_s, U_e, or U_u, subject to the government budget constraint that $B \geq 0$. To facilitate the later analysis, the remainder of this section states the optimality conditions for a social planner, an employed worker, and an unemployed worker who maximize U_s, U_e, and U_u, respectively, subject to $B \geq 0$. Sections 3 and 4 then deduce the implications of these optimality conditions for equilibrium tax and transfer policy in various variants of the general model.

The social planner is interested in maximizing the Lagrangian expression $L_s = U_s + \lambda B$, where λ is the Lagrange multiplier associated with the government budget constraint. Note that if $\underline{a} > 0$, then unemployment benefits, b, also have to be positive to induce any individuals to leave the labor force. Let $\underline{b}$ be the unemployment benefit level such that workers of quality $\underline{a}$ are indifferent between working and not working. For any workers to exit from the labor force, we need $b \geq \underline{b}$. The optimality conditions of a social planner's maximization problem with respect to τ, b, and t are now as follows,

$$\frac{dL_s}{d\tau} = -Y - b(1-S) + \alpha(1-\tau) Y \frac{\mu - \hat{a}}{\mu S} f(\hat{a}) \frac{d\hat{a}}{d\tau} + \lambda \frac{dB}{d\tau} = 0 \quad \wedge \quad \tau \geq 0$$
$$\text{or } \tau = 0 \tag{13a}$$

$$\frac{dL_s}{db} = (1-\tau)(1-S) + \alpha(1-\tau) Y \frac{\mu - \hat{a}}{\mu S} f(\hat{a}) \frac{d\hat{a}}{db} + \lambda \frac{dB}{db} = 0 \quad \wedge \quad b \geq \underline{b}$$
$$\text{or } b < \underline{b} \tag{13b}$$

$$\frac{dL_s}{dt} = 1 - \lambda = 0 \tag{13c}$$

where,

$$\frac{dB}{d\tau} = Y + b(1 - S) - (1 - \tau) b f(\hat{a}) \frac{d\hat{a}}{d\tau} + \tau \frac{dY}{d\tau}$$

$$\frac{dB}{db} = - (1 - \tau)(1 - S) - (1 - \tau) b f(\hat{a}) \frac{d\hat{a}}{db} + \tau \frac{dY}{db}$$

$$\underline{b} = \underline{a} [x \bar{\mu}^{\alpha} + \frac{V(1 - x) - V(1)}{1 - \tau}] \geq 0$$

and where use is made of the fact that $dB/dt = - 1$.

An employed worker instead is interested in maximizing the Lagrangian expression $L_e = U_e + \lambda B$. The optimality conditions associated with this maximization problem with respect to τ, b, and t are as follows,

$$\frac{dL_e}{d\tau} = - y + \alpha (1 - \tau) y \frac{\mu - \hat{a}}{\mu S} f(\hat{a}) \frac{d\hat{a}}{d\tau} + \lambda \frac{dB}{d\tau} = 0 \quad \wedge \quad \tau \geq 0 \text{ or } \tau = 0 \qquad (14a)$$

$$\frac{dL_e}{db} = \alpha (1 - \tau) y \frac{\mu - \hat{a}}{\mu S} f(\hat{a}) \frac{d\hat{a}}{db} + \lambda \frac{dB}{db} = 0 \quad \wedge \quad b \geq \underline{b} \text{ or } b < \underline{b} \qquad (14b)$$

$$\frac{dL_e}{dt} = 1 - \lambda = 0 \qquad (14c)$$

Finally, an unemployed individual is interested in maximizing the Lagrangian expression $L_u = U_u + \lambda B$. The resulting optimality conditions with respect to τ, b, and t are as follows,

$$\frac{dL_u}{d\tau} = - b + \lambda \frac{dB}{d\tau} = 0 \quad \wedge \quad \tau \geq 0 \text{ or } \tau = 0 \qquad (15a)$$

$$\frac{dL_u}{db} = (1 - \tau) + \lambda \frac{dB}{db} = 0 \quad \wedge \quad b \geq \underline{b} \text{ or } b < \underline{b} \tag{15b}$$

$$\frac{dL_u}{dt} = 1 - \lambda = 0 \tag{15c}$$

In the remainder of this paper, we examine the implications for the setting of tax and redistributive policy of the sets of optimality conditions (13), (14), and (15).

3. *The determination of policy with a limited set of policy instruments*

This section considers the three cases where the policy instrument set consists of only two instruments in turn. The three cases are considered in three subsections.

3.1 *Only income taxation and lump sum transfers available*

In this subsection, we consider that the proportional income tax at a rate τ and lump sum transfers, *t*, are the only policy instruments in existence. In the absence of unemployment benefits, all workers are employed. First, we can consider that the policy instruments, τ and *t*, are set by a social planner, as guided by optimality conditions (13a) and (13c). From (13c), we see that $dL_s/dt = 0$ implies $\lambda = 1$. Noting $\lambda = 1$, we see from (13a) that optimally $\tau = 0$.[3] This implies that a social planner optimally will not use income taxation to redistribute income. This is because income taxes only distort the labor supply decision without any offsetting benefits in terms of higher social welfare.[4] Next, let us consider what is the optimal policy from the perspective of an employed agent. For an employed person of quality *a*, the optimality conditions are (14a) and (14c). Again (14c) implies that $\lambda = 1$. Noting this, we can solve from the optimal income tax rate, $\tau^*(a)$, for an agent of quality *a* from (14a) as follows,

$$\tau^*(a) = \frac{\overline{\mu} - a}{\overline{\mu}} \cdot \frac{1}{\varepsilon_\ell} \quad \text{if} \quad a \leq \overline{\mu} \tag{16}$$

where $\varepsilon_\ell = -\frac{dx}{d\tau} \cdot \frac{1}{x} > 0$.

If second order conditions hold, there is a unique value of τ as in (16) that maximizes individual welfare and each agent's preferences over values of τ are single-peaked. From (16), we can infer that the optimal value of τ from an individual worker's perspective declines with his quality, a. In this instance, the median voter is the worker of median quality, denoted a_m. This result can be stated as follows,

Proposition 2: If lump sum transfer, t, are financed by income taxation at a rate, τ, then the voting equilibrium reflects the preferences of the median voter who is the median quality worker. This voter favors positive values of the income tax, τ, and the transfer, t, if his quality, a_m, is less than the mean quality, $\bar{\mu}$.

3.2 *Only unemployment benefits and lump sum taxes available*

In this subsection, we consider the case where unemployment benefits, b, and lump sum transfers, t, are the available policy instruments. To start, we will consider the welfare implications of unemployment benefits just high enough to induce the lowest quality workers to exit from the labor force. Again, we will consider such unemployment benefits from the perspectives of a social planner, an employed individual, and an unemployed individual. For the social planner, the relevant first order conditions are (13b) and (13c). The social planner favors the introduction of unemployment benefits if $dL_u/db > 0$ with $b = \underline{b}$ in (13a), where $\lambda = 1$ from (13c). This is the case if,

$$\alpha Y \frac{\bar{\mu} - \underline{a}}{\bar{\mu}} > \underline{b} \tag{17}$$

According to (17), the social planner favors unemployment benefits, if the social productivity externality resulting from the exit of a worker of quality $\underline{a}$ exceeds the unemployment benefit $\underline{b}$. It can be shown that (17) is satisfied if $\bar{\mu}/\underline{a} > (1 + \alpha)/\alpha$.[5] Next, we consider the dermination of unemployment benefits from the perspective of an employed individual, guided by first order

conditions (14b) and (14c). An employed person of quality a is in favor of non-trivial unemployment benefits with $b > \underline{b}$ if,

$$\alpha y \frac{\bar{\mu} - \underline{a}}{\bar{\mu}} > \underline{b} \tag{18}$$

A worker of quality a favors the introduction of unemployment benefits, if the increase in his own productivity resulting from labor market exists exceeds the unemployment benefit level, $\underline{b}$. As individual output, y, is proportional to labor quality, a, it follows from (18) that workers of quality higher than a certain minimum level (if any) will support non-trivial unemployment benefits. Equation (18) implies, however, that the introduction of unemployment benefits financed by a lump sum tax may harm the lowest qualified employed workers.[6] The interests of lowly and highly qualified employed workers thus generally diverge, if unemployment benefits, b, are financed by a lump sum tax, t.

Finally, we can consider whether the introduction of non-trivial employment benefits actually benefits the people rendered unemployed. To check this, note that an unemployed person's relevant optimality conditions are (15b) and (15c). The lowest qualified individuals, of quality $\underline{a}$, benefit from the introduction of non-trivial unemployment benefits if,

$$1 - \underline{b} f(\underline{a}) \frac{d\hat{a}}{db} > 0 \tag{19}$$

Equation (19) essentially indicates that the lowest quality unemployed benefit from higher unemployment benefits if the increase in the unemployment benefits exceeds the increase in the lump sum tax necessary to finance the higher unemployment benefits. A sufficient condition for (19) to be satisfied is $f(\underline{a})\underline{a} < 1$.[7] The above results on the desirability of unemployment benefits are summarized as follows,

Proposition 3: The introduction of low unemployment benefits, financed by lump sum taxation on all, (i) may or may not benefit those rendered unemployed and lowly qualifed employed workers, and (ii) it benefits employed workers of quality higher than a certain threshold level (if any).

Next, we in turn consider the optimal level of unemployment benefits from the perspectives of a social planner, an employed worker and an unemployed worker. Starting with the social planner, we can solve from equation (13b) and (13c) for the socially optimal unemployment benefit level financed by lump sum taxation, $b_{t,s}^{*}$, as follows,

$$b_{t,s}^{*} = \alpha Y \frac{\mu - \hat{a}}{\mu S} \tag{20}$$

Similarly, the optimal unemployment benefit from the perspective of an employed worker of quality a, $b_{t,e}^{*}(a)$, can be found from (14b) and (14c) as follows,

$$b_{t,e}^{*}(a) = \alpha y \frac{\mu - \hat{a}}{\mu S} - \frac{1}{\varepsilon_u} \tag{21}$$

where $\varepsilon_u = \frac{d(1-S)}{db} \frac{1}{1-S} = \frac{d\hat{a}}{db} \frac{f(\hat{a})}{F(\hat{a})} > 0.$

The first term on the right of (21) is simlar to expression (20). Expression (21), however, reflects that each worker is interested in how unemployment benefits affect his own output, y, rather than aggregate output, Y. Also expression (21) has a negative final term which reflects that an employed person, unlike the social planner, does not value increases in the benefit income of the unemployed per se.

Finally, we can solve for the optimal unemployment benefit from the perspective of all unemployed workers, $b_{t,u}^{*}$, from equations (15b) and (15c) as follows,

$$b_{t,u}^{*} = \frac{S}{1-S} \cdot \frac{1}{\varepsilon_u} \tag{22}$$

The optimal unemployment benefit increases with the employed share of the population, S, that can help finance the unemployment benefits without being at the same time beneficiaries.

Before we consider voting on unemployment benefits, we have to examine agents' preferences over values of the unemployment benefits, as either employed or unemployed workers. To this end, let $U_e(b_t,a)$ be the welfare reached by agents of quality a as employed workers given that

unemployment benefits, b, are financed by a lump sum tax, t. The utility index, $U_e(b_t,a)$, presupposes that the agent of quality a chooses individual labor supply optimally, while all other agents choose their employment status and labor supply optimally. We see immediately from (5) that $dU_e(b_t,a)/da > 0$. At the same time, we know from (21) that the optimal value of b, $b_{t,e}^*(a)$ increases with a, provided $b_{t,e}^*(a)$ exceeds $\underline{b}$. The index $U_e(b_t,a)$ is presented in Figure 1 for two worker quality levels a_1 and a_2, with $a_2 > a_1$. The figure reflects the assumption that an agent's preferences as an employed worker over different levels of unemployment benefits, b, are single-peaked.

Next, we can define $U_u(b_t,a)$ to be the welfare obtained by agents of quality a as unemployed workers given that benefits, b, are financed by a lump sum tax, t. Again all other workers are assumed to have chosen their employment status and their individual labor supply, x, optimally. Using (6), we see that $dU_u(b_t,a)/da = V(1)$, which is independent of quality a. This confirms the result from (22) that the optimal unemployment benefit, $b_{t,u}^*$, from an unemployed worker's perspective, is independent of the transfer b. Figure 2 represents the index $U_u(b_t,a)$ for two worker quality levels a_1 and a_2, with $a_2 > a_1$. We assume that an agent's preferences as an unemployed worker over different levels of unemployment benefits, b, are single-peaked.

A worker of quality a chooses to be employed if $U_e(b,a) > U_u(b,a)$ and vice versa. In fact, for any benefit level, b, there is a borderline quality level $\hat{a}$, above (below) which agents choose to be (un)employed according to (7). Note that a worker's ability to change his employment status implies that preferences over different levels of employment benefits, b are generally double-peaked, even if preferences as either an employed or an unemployed worker are single-peaked. In fact, an agent's preferences are double-peaked, if (i) $b_{t,e}^*(a) < b_{t,u}^*$, and (ii) the worker decides to become unemployed at a benefit level below $b_{t,u}^*$.[8]

In this case of generally double-peaked preferences, there may still be a unique voting outcome. To see whether this is the case, we proceed as follows. We first consider what would be the outcome preferred by the median quality voter. Then we consider whether this solution can be beaten by a direct comparison with another outcome, and if so how. We now have to consider three cases: (i) $U_e(b_{t,e}^*(a_m),a_m) > U_u(b_{t,u}^*,a_m)$ and $b_{t,e}^*(a_m) \geq b_{t,u}^*$, (ii) $U_e(b_{t,e}^*(a_m),a_m) > U_u(b_{t,u}^*,a_m)$ and $b_{t,e}^*(a_m) < b_{t,u}^*$ and (iii) $U_e(b_{t,e}^*(a_m),a_m) \leq U_u(b_{t,u}^*,a_m)$. In case (i), the median quality worker prefers to be employed at a benefit level exceeding b_u^*. Now all (employed) workers with $a > a_m$ wish to

have higher benefits, while all workers with $a < a_m$, whether employed or unemployed, wish to have lower benefits. In this instance, the median quality worker's wishes are implemented. Case (ii) is somewhat more complicated. Now workers with $a > a_m$, who are employed, as before, wish to increase the benefit level beyond $b_{t,e}^*(a_m)$. This is also the case for unemployed workers, as $b_{t,e}^*(a_m) < b_{t,u}^*$. It follows that more than half the electorate is in favor of a small increase in b beyond $b_{t,e}^*(a_m)$. Thus the outcome preferred by the median quality worker cannot be a voting equilibrium. A complicating matter to determine possible voting outcomes in this case is that the coalition in favor of marginal increases in b may either decline or increase, as previously employed join the ranks of the unemployed who are in favor of higher values of b. As a result the existence of multiple voting equilibria cannot be excluded. Any equibrium, however, will be larger than $b_{t,e}^*(a_m)$ and less than or equal to $b_{t,u}^*$. Finally, in case (iii) the median quality worker attains highest welfare at a benefit level $b_{t,u}^*$. This will be strictly the case for all agents with $a < a_m$. In this case, the benefit level $b_{t,u}^*$ is the unique voting outcome.

The most interesting result is, perhaps, that in case (ii) the median quality worker can be outvoted by a coalition of highly qualified employed workers and unemployed workers in order to increase the benefit level. This result is summarized as follows,

Proposition 4: If the median quality worker reaches highest utility as an employed person for a benefit level below $b_{t,u}^*$, then a coalition of the unemployed and of highly qualified employed workers will be able to implement a benefit level higher than the one preferred by the median quality worker.

This result indicates a potential conflict of interest between the lowly qualified employed and the highly qualified employed over the desired level of benefits. Underlying this conflict is the fact that higher benefits, in terms of higher individual productivity, accrue in proportional to an employed person's quality, while the tax burden, in the form of a lump sum tax, is equal for all employed workers. In the next subsection, we instead consider unemployment benefits that are financed through a proportional tax on labor income. Labor income for employed workers, in turn, is proportional to labor quality. In this case, the benefits and costs of higher unemployment

benefits for all employed workers are proportional to labor quality. As a result, there no longer is a potential conflict of interest among employed workers.

3.3 *Only unemployment benefits and income taxes available*

In this subsection, unemployment benefits, b, are financed only by a proportional tax, τ, on labor income. The discussion in this subsection closely follows Huizinga (1994). Let $U_e(b_\tau,a)$ now be the welfare of an individual of quality a as an employed worker if benefits, b, are financed by a labor income tax, τ. As before, we assume that all agents of quality other than a have chosen their employment status and their individual labor supply, x, optimally. It is immediate that $U_e(b_\tau,a)$ is proportional to labor quality a, which implies that $U_e(b_\tau,a)$ reaches a maximum for a value of b that is independent of a. Analogously, let $U_u(b_\tau,a)$ be the utility of an agent of quality a as an unemployed worker. Using the expression for U_u in (6), we see that $U_u(b_\tau,a)$ reaches a maximum for value of b and τ that are independent of a. Let $b_{\tau,u}^*$ ($b_{\tau,e}^*$) now be the value of b and τ_u^* (τ_e^*) the tax rate that maximizes $U_u(b_\tau,a)$ ($U_e(b_\tau,a)$) for all workers. We can obtain the following result,[9]

Proposition 5: All agents prefer a higher benefit and tax rate as an unemployed worker than as an employed worker, i.e. $b_{\tau,u}^* > b_{\tau,e}^*$ and $\tau_u^* > \tau_e^*$.

Again, the welfare indices $U_e(b_\tau,a)$ and $U_u(b_\tau,a)$ are assumed to be single-peaked in b. Agents can change their employment status, however, and, therefore, overall preferences over values of b generally are double-peaked. Individual preferences, specifically, are double-peaked for those agents that change their employment status for a value of b between $b_{\tau,e}^*$ and $b_{\tau,u}^*$.

In this model, the voting outcome will always reflect the preferences of the median voter. To see this, let us assume that the median quality worker prefers to be unemployed at a benefit level $b_{\tau,u}^*$. It is straightforward that all workers with $a < a_m$ also prefer to be unemployed at the same benefit level. Alternatively, the median quality worker can prefer to work at a benefit level $b_{\tau,e}^*$. In this instance, all workers with $a > a_m$ also prefer to work at the same benefit level. These results are summarized as follows,

Proposition 6: If the unemployment income, *b*, is financed by a proportional income tax, τ, then if the median quality worker prefers to be (un)employed at a benefit level $b_{\tau,e}^{*}$ $(b_{\tau,u}^{*})$ so will all workers of higher (lower) quality. As a result, the voting outcome reflects the preferences of the median quality worker.

Interestingly, the median voter can be indifferent between working and not working if $U_u(b_{\tau,u}^{*},a) = U_e(b_{\tau,e}^{*},a)$. In this instance, the outcome of the vote is not unique. More specifically, $b_{\tau,e}^{*}$ and $b_{\tau,u}^{*}$ are possible voting outcomes regarding the unemployment benefit level. While the median quality worker may be indifferent between the two possible voting outcomes, this is not the case for other workers. Workers of higher (lower) quality than the median quality worker, in particular, prefer the lower (higher) level of unemployment benefits. Note that the indifference between the two voting outcomes on the part of the median quality worker is fragile in the sense that a small change in the composition of the population can change the indifference by the median quality worker between the two outcomes. Small changes in the population, for instance resulting from migration, thus can bring about a large change in the unemployment benefit system with discrete changes in welfare for all but the median ability worker.[10]

4 *All three instruments available*

In this section, all three fiscal instruments, *b*, τ and *t*, are available. As in section 3.1, the social planner will never use the income tax instrument, τ. Employed and unemployed persons, however, generally wish to employ all three instruments, if decisions where left to the individual. This section addresses two issues. First, starting from a voting equilibrium where only unemployment benefits, *b*, and lump sum taxes, *t*, exist, we address whether voters will favor the introduction of proportional income taxes. Second, we consider the issue of the voting equilibrium where all three fiscal instruments are available. At least in specific cases, we can say what the voting equilibrium entails.

Starting with the first issue, let us assume that there exists a voting equilibrium in the unemployment benefit level, *b*, and the lump sum tax, *t*. Which voters will be in favor of a positive level of the income tax rate, τ? Proposition 2 states that in the absence of unemployment

benefits all voters of lower than the mean quality favor positive income taxes. Here we show that a broader segment of the population favors such an introduction if unemployment benefits are already is in place. Specifically, we can state the following results,

Proposition 7 (i): If b and t be chosen optimally from the perspective of an unemployed worker, such that $b, t > 0$, then this unemployed person favors a positive income tax rate, τ. *(ii)*: Let b and t instead be chosen optimally from the perspective of an employed person of quality a such that $b, t > 0$. This employed person can then benefit from a positive income tax level, if $a < (1 - S)\bar{a} + S\mu$. The median quality worker, of quality a_m, specifically benefits from such an introduction if $a_m < (1 - S)\bar{a} + S\mu$.

Comparing propositions 2 and 7, we see that the median voter is in favor of introducing positive labor income taxes under broader conditions if $b, \tau > 0$ than if $b = \tau = 0$, as $(1 - S)\bar{a} + S\mu > \bar{\mu}$. In this sense, unemployment benefits and proportional income taxation are shown to be complementary.

To conclude this section, we consider how preferences of employed and unemployed workers over policy choices generally diverge, and the implication for voting in the case where all three instruments are available. We can state the following results,

Proposition 8 (i): If the three instruments are set so as to maximize the welfare of any unemployed agent, then all employed workers wish to implement lower values of b and of τ. *(ii)*: If the three instruments are instead set so as to maximize the welfare of an employed agent of quality a', then (first) all employed agents of quality $a > a'$ wish to increase b and to reduce τ, and (second) all employed agents of quality $a < a'$ wish to reduce b and to increase τ, and (third) all unemployed agents wish to increase b and τ.

If the median quality worker obtains highest welfare by being unemployed, then this is also the case for all workers of lower quality. In this instance, the median quality worker is the median voter and there is a unique voting equilibrium. Alternatively, the median quality worker can obtain

highest welfare as an employed worker. As in section 3.2, there now is generally a majority coalition of unemployed and of highly qualified employed workers that wishes to increase the value of the benefit, b, for a given value of τ. The policy configuration preferred by the median quality worker thus cannot be a voting equilibrium. Voting for this case is not further pursued here.

5. *Conclusion*

This paper starts from the premise that a worker's productivity depends on his own quality as well as on the quality of other employed workers. As a result, the model displays what can be called increasing returns to average quality: the output of a group of workers increases more than linearly with the average worker quality. A main feature of the model is that a system of unemployment benefits to low quality workers so as to remove them from the labor market can increase total output. In this setting, unemployment compensation has the dual role of effecting efficient exists from the labor market and of redistributing income. The political process takes both aspects of the transfer system into account. The paper considers policy as determined by a social planner and by majority voting.[11] A main result of the paper is that it may be in the interest of employed workers to support unemployment benefits. This result is consistent with the reality that many countries have unemployment schemes, while the majority of voting age individuals do not receive unemployment benefits.

While the present model rationalizes unemployment compensation, it cannot be taken to imply that any large-scale unemployment is in fact socially desirable. This reflects that the model is highly stylized in at least two respects: (i) the model is entirely static, and (ii) workers can only be employed in a sector characterized by labor market externalities or be unemployed. This negates that in practice workers may temporarily engage in training before entering or reentering the work place.

At the same time, real economies consist of many sectors that are characterized by labor quality externalities to different extents. To reflect this, the model could include an additional sector without any labor quality externalities at all. In this second sector, a worker's product could simply equal their own individual quality, or it could be a constant for all employed workers. In

the second instance, employment in this second sector is immediately analogous to unemployment in the present model. In this amended model, there remains a scope for tax policy to affect the allocation of workers between the two sectors, even if all workers are employed. More generally, there is a scope for tax and transfer policy to affect employment in all the economy's sectors as well as unemployment.

Appendix

The derivatives in equation (8) are as follows,

$$\frac{d\hat{a}}{db} = \frac{1}{\beta} > 0 \qquad \text{(A1)}$$

$$\frac{dx}{db} = -\frac{(1-\tau)\alpha\mu^{\alpha}\cdot\frac{\mu-\hat{a}}{\mu S}f(\hat{a})}{V''(1-x)\beta} > 0 \qquad \text{(A2)}$$

$$\frac{d\hat{a}}{d\tau} = \frac{\hat{a}\left(V(1)-V(1-x)\right)}{(1-\tau)^2\beta} > 0 \qquad \text{(A3)}$$

$$\frac{dx}{d\tau} = \frac{\left[V'(1-x)-\frac{V(1)-V(1-x)}{x}\right]\beta+\left[\frac{V(1)-V(1-x)}{x}\right]\frac{b}{\hat{a}}}{V''(1-x)(1-\tau)\beta} < 0 \qquad \text{(A4)}$$

where,

$$\beta = \frac{b}{\hat{a}} + x\hat{a}\alpha\mu^{\alpha}\frac{\mu-\hat{a}}{\mu S}f(\hat{a}) > 0$$

Proof of proposition 7:

Part (i):

We wish to show that all unemployed workers can benefit from a positive value of τ. This is the case if $dL_u/d\tau > 0$ in (15a) for $\tau = 0$ given that $dL_u/db = 0$ in (15b). Thus we need to show that,

$$-b + Y + b(1-S) - S\frac{d\hat{a}/d\tau}{d\hat{a}/db} > 0$$

where $\frac{S}{d\hat{a}/db}$ has been substituted for $bf(\hat{a})$ form (15b) into (15a).

After substituting for $d\hat{a}/d\tau$ and $d\hat{a}/db$ from (A3) and (A1), we get,

$$-b + Y + b(1-S) + S\hat{a}\left(V(1-x)-V(1)\right) =$$

$Y - S\,[\, b - \hat{a}(V(1 - x) - V(1))\,] =$ (using (7))

$Y - S\,[x\,\hat{a}\,\mu^{\alpha}] =$ (using (2))

$S\,x\,\mu^{\alpha}\,(\mu - \hat{a}) > 0$.

Part (ii):

We wish to show that agents of quality a lower than $(1 - S)\hat{a} + S\mu$ can benefit from a positive value of τ, if b is set so as to maximize the welfare of an employed worker. Thus, we need to show that $dL_e/d\tau > 0$ for $\tau = 0$ in (16a) given that dL_e/db and $\lambda = 1$ in (14b).

This is the case if,

$$-y + Y + b(1 - S) + (1 - S)\frac{d\hat{a}/d\tau}{d\hat{a}/db} > 0$$

where $\dfrac{1 - S}{d\hat{a}/db}$ is substituted for $\left(\alpha y \dfrac{\mu - \hat{a}}{\mu S} - b\right) f(\hat{a})$ from (14b) into (14a).

Substituting from (A1) and (A3), we get,

$- y + Y + b(1 - S) + (1 - S)\,\hat{a}(\,V(1) - V(1 - x)\,) =$ (using (7))

$-y + Y + b(1 - S) - (1 - S)\,[\, b - x\hat{a}\mu^{\alpha}\,] =$ (using (2))

$x\,\mu^{\alpha}\,[\, - a + (1 - S)\hat{a} + S\mu\,]$

This shows that an individual of quality a can benefit from a positive income tax, τ, if $a < (1 - S)\hat{a} + S\mu$.

Proof of proposition 8:

Part (i):

Proposition 5 states that an employed person wishes lower values of b as well as of τ for the case of $t = 0$. With $t = 0$, the λ's in eq. (14a, b) and (15a, b) are generally different from 1. However, the proof remains valid if $t \neq 0$, which implies λ is equal to 1 in (14a, b) and (15a, b).

Part (ii):

To show the first and second statements note that,

$$\frac{d^2 L_e}{d\tau\, da} = \frac{dy}{da}\left[-1 + \alpha(1-\tau)\,\frac{\mu - \hat{a}}{\mu S} f(\hat{a})\frac{d\hat{a}}{d\tau}\right]$$

Noting that $dy/da = x\mu^{\alpha}$ and substituting for $d\hat{a}/d\tau$ from (A3) we set after rearranging,

$$\frac{d^2 L_e}{d\tau\, da} = x\mu^{\alpha} \cdot \frac{\alpha\frac{\mu - \hat{a}}{\mu S}[\hat{a}[V(1) - V(1-x)] - (1-\tau)x\hat{a}\mu^{\alpha}] f(\hat{a}) - (1-\tau)\frac{b}{\hat{a}}}{(1-\tau)\left[b/\hat{a} + \alpha x \hat{a}\,\mu^{\alpha}\frac{\mu - \hat{a}}{\mu S} f(\hat{a})\right]} < 0$$

Noting that $\hat{a}[V(1) - V(1 - x)] - (1 - \tau)x\,\hat{a}\,\mu^{\alpha} = -b(1 - \tau)$ from (7) we see that the above expression is negative.

Also note that,

$$\frac{d^2 L_e}{db\, da} = x\mu^{\alpha}\alpha(1-\tau)\,\frac{\mu - \hat{a}}{\mu S} f(\hat{a})\frac{d\hat{a}}{db} > 0$$

These two derivatives imply the first and second statements. The third statement is the mirror image of part (i) of this proposition. The proof is therefore analogous.

References

Arnott, Richard and John Rowse, 1987, Peer Group Effects and Educational Attainment, *Journal of Public Economics* 32, 287-305.

Bailey, Martin Neil, 1978, Some Aspects of Optimal Unemployment Insurance, *Journal of Public Economics* 10, 379-401.

Boadway, Robin W. and Andrew J. Oswald, 1983, Unemployment Insurance and Redistributive Taxation, *Journal of Public Economics* 20, 193-210.

Cooter, R. and E. Helpman, 1974, Optimal Income Taxation for Transfer Payments, *Quarterly Journal of Economics* 88, 656-670.

Fleming, J.S., 1978, Aspects of Optimal Unemployment Insurance: Search, Leisure, Savings and Capital Market Imperfections, *Journal of Public Economics* 10, 302-425.

Henderson, Vernon, Peter Mieszkowski and Yvon Sauvageau, 1978, Peer Group Effects and Educational Attainment, *Journal of Public Economics* 10, 97-106.

Huizinga, Harry, 1994, The Political Economy of Unemployment Benefits in the Presence of Labor Quality Externalities, Externalities, mimeo, Tilburg Univeristy.

Kremer, Michael, 1993, The O-Ring Theory of Economic Development, *Quarterly Journal of Economics* 108, 551-575.

Kristov, Lorenzo, Peter Lindert and Robert McClelland, 1992, Pressure Groups and Redistributio n , *Journal of Public Economics* 48, 135-163.

Meltzer, Allan H. and Scott F. Richards, 1981, A Rational Theory of the Size of Government, *Journal of Political Economy* 89, 914-927.

Mirrlees, J.A., 1971, An Exploration in the Theory of Optimum Income Taxation, *Review of Economic Studies* 38, 175-208.

Sala-i-Martin, Xavier, 1992, Transfers, NBER WP No. 4186.

Wright, Randall, 1986, The Redistributive Roles of Unemployment Insurance and the Dynamics o f Voting, *Journal of Public Economics* 31, 377-399.

Zeckhauser, R., 1971, Optimal Mechanisms for Income Transfer, *American Economic Review* 61, 324-334.

Endnotes

1. The description of the basic model draws heavily on Huizinga (1994).

2. Kremer (1993) analyses an alternative production function characterized by labor quality externalities. Production, in particular, is assumed to consist of a number of tasks that all have to be completed successfully for the produced output to have any value.

3. Note that in the absence of unemployment benefits we have,

$$\frac{dL_s}{d\tau} = \tau \frac{dY}{dx}\frac{dx}{d\tau} = \tau \mu^{1+\alpha} \frac{\mu^{\alpha}}{V''(1-x)} < 0$$

4. Income redistribution per se does not yield higher social welfare, as consumption, *C*, enters the utility specification in (3) linearly.

5. Using (2) and the expression for $\underline{b}$, we see that (17) is equivalent to,

$$[\alpha\bar{\mu} - (1+\alpha)\underline{a}]x\bar{\mu}^{\alpha} + \underline{a}[V(1) - V(1-x)] > 0$$

6. To see this, note that we can substitute for *y* from (1) and for $\underline{b}$ into (18) to reach,

$$\frac{\alpha a(\bar{\mu} - \underline{a}) - \underline{a}\bar{\mu}}{\bar{\mu}} x\bar{\mu}^{\alpha} + \underline{a}[V(1) - V(1-x)] > 0$$

The above inequality is not satisfied if, for instance, $a = \underline{a}$ with $\alpha < 1$ and $V(1) = V(1 - x) = 0$.

7. To check this, note that (19) is equivalent to,

$$[x\bar{\mu}^{\alpha} + V(1-x) - V(1)][1 - f(\underline{a})\underline{a}] + x\bar{\mu}^{\alpha}[f(\underline{a})\underline{a}]\alpha\frac{\bar{\mu} - \underline{a}}{\bar{\mu}} > 0$$

8. A sufficient condition for double-peakedness is that an employed agent loses from unemployment benefits that are increased from the minimum level $\underline{b}$.

9. For a proof, see Huizinga (1994).

10. Huizinga (1994) analyses how an influx of quality workers of mimimum quality affects the tax and transfer system if there are unemployment benefits financed by a proportional labor income tax. At some point a discrete drop in both the unemployment benefit and the tax rate occurs as the decisive voter is better off being employed than being unemployed.

11. Alternatively, it may be interesting to consider policy as affected by pressure groups in the present model.See Kirstov, Lindert and McClelland (1992) for a recent analysis of pressure groups as they affect redistribution.